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SELF-CLEANING PISTON

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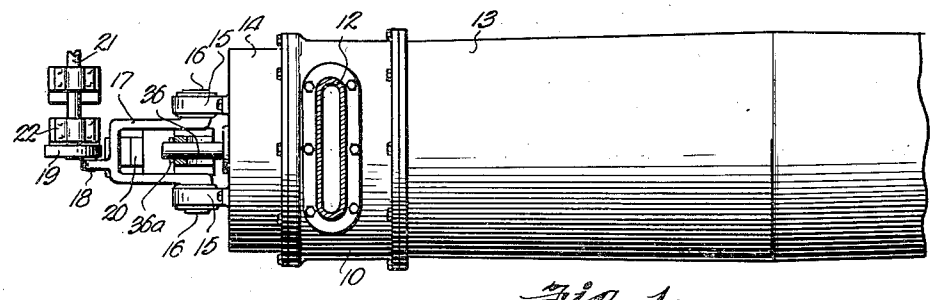


Fig. 1.

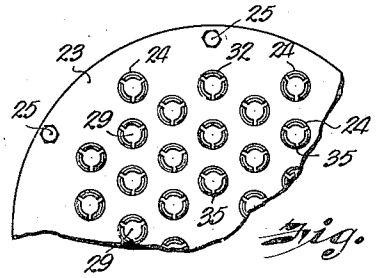


Fig. 3.

Fig. 2.

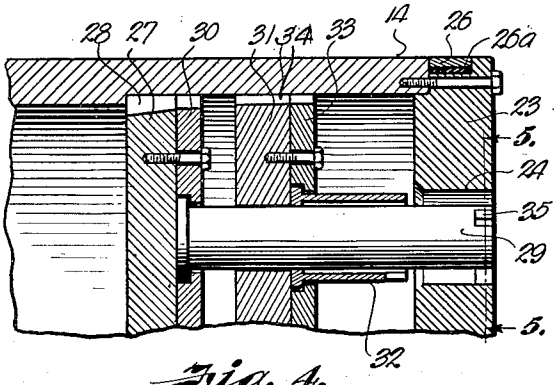


Fig. 4.

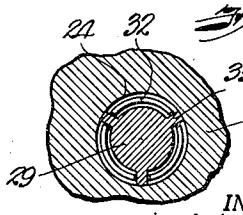


Fig. 5.

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SELF-CLEANING PISTON

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5 Claims. (Cl. 100—50)

This invention relates to improvements in a self-cleaning piston press and fluid extracting device and refers more particularly to a press useable in the manufacture of pulp from cellulose-containing vegetable material such as wood chips, bagasse, straw, bamboo, and other well known sources of cellulosic material. The novelty in the invention resides primarily in the structural features of a self-cleaning piston reciprocating in a pressure chamber. The extracted fluid is drained through apertures in the pressure face of the piston and the apertures cleaned automatically by extruding elements functioned by the piston reciprocation.

In the extraction of liquid from an absorbent substance where the liquid is drained through apertures in the pressure member it is difficult to prevent clogging of the apertures due to accumulation of the absorbent material, gums, resins, and other accumulating substances. This problem becomes increasingly troublesome where high pressures must be employed during the extraction operation. In the digestion of vegetable matter to obtain cellulosic constituents therefrom presses of this character are used to impregnate and charge the material to the digester and to extract liquor from the material after digestion or subsequent to diluting or washing operations which follow digestion. The self-cleaning press and fluid extracting device hereinafter described is particularly adapted to these purposes.

In the accompanying drawing which forms a part of the specification and is to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in the various views,

Fig. 1 is a diagrammatic plan view of one end of a press in which the invention is used showing the driving mechanism,

Fig. 2 is a sectional side view of the press with the reciprocating mechanism shown diagrammatically,

Fig. 3 is a fragmentary front view of the pressure face of the piston,

Fig. 4 is an enlarged sectional view of the self-cleaning mechanism, and

Fig. 5 is a sectional view taken along the line 5—5 in Fig. 4.

Referring to the drawing, the press consists of a pressure cylinder 10 mounted upon a suitable base 11. In the top of the vessel is an inlet opening 12 for charging material to the press. In the side of the vessel is an opening 13 for discharging the absorbent material from the press after as much of the liquid as desired has been extracted therefrom. In removing liquid from absorbent vegetable material as in the manufacture of pulp, the interior shape, type of metal and character of the metal surface of the pressure cylinder is designed to produce compacting within the vessel. Details of this shaping of the vessel are not shown in the drawing, but are well known in practice. In other words, the interior of the pressure vessel is so designed as to tightly compact the absorbent material within the cylinder in front of the piston during the fluid extracting operation. Reciprocating in an open end of the pressure cylinder beneath inlet opening 12 is a hollow piston 14. At the rear or driving end of the piston are cross head supports 15 in which bear cross head pins 16. A Y-shaped connecting rod or yoke 17 connects crank pin 18 on the rotating crank 19 to cross head pins 16. The forks of the yoke 17 straddle a stop 20. Crank 19 is mounted upon a shaft diagrammatically indicated at 21, carried by support member 22.

Describing now the self-cleaning mechanism of the piston, mounted on the open end or front of the piston is a face or pressure plate 23 which has a plurality of apertures 24 distributed over its surface and extending through the plate. The pressure plate 23 is flanged near its outer edge to fit the front edge of the piston and is attached thereto by means of bolts 25. A piston ring 26 and flexible backing ring 26a between the flange of the pressure plate and the piston assure a pressure-tight joint between the piston and cylinder. Within the hollow piston is positioned a fixed disk 27 apertured at intervals around its circumference as shown at 28 to permit the passage of fluid by the disk. On the front face of this fixed disk are filter pins 29. These pins are held in place by a thin disk or holding plate 30 bolted to the front of the fixed disk 27. The holes in the holding disk 30 fit the peripheries of the filter pins loosely establishing the pins in the face of the fixed disk by seating upon the shoulders formed by their enlarged ends.

Intermediate the pressure plate 23 of the piston and the fixed disk 27 is a movable or reciprocating disk 31. On the front face of disk 31 are a plurality of tubular members or sleeves 32. The lower extremities of sleeves 32 have flanges which are engaged by holding disk 33 establishing the sleeves loosely on the face of the movable disk. The sleeve holding disk 33 is bolted to the movable disk 31 as shown in Fig. 2. Sleeves 32 surround the filter pins 29 and advance into the apertures in the pressure plate 23 of the piston during its backward stroke. Around the circum-

ference of the movable disk are ducts **34** which permit the passage of liquid by the movable disk, serving the same function as ducts **28** in the fixed disk **27**.

Arranged at intervals upon the outer surface of the filter pins near their front ends are guide members **35** which extend longitudinally of the pins in the annular passageways formed by the pins with the apertures in the pressure plate. The functions of these guides are to locate and hold the pins accurately in a central position within the holes. The front edges of the sleeves **32** are slotted to accommodate the filter pin guides.

Extending centrally through the rear face of the piston is a stop rod **36**. A gland **37** and a stuffing box **38** in the piston prevent leakage around the rod. Rod **36** extends through an aperture in the fixed plate **27** and is attached to the movable plate by a nut which is screwed onto the threaded forward end of the rod. The movable plate is held between the nut and a shoulder formed in the rod. The threaded front end of the rod designated by the number **36***a* extends into a well **23***a* drilled in the rear face of pressure plate **23** and a compression spring **39** positioned in the well ahead of the stop rod imposes pressure rearwardly upon the rod and movable plate. To supplement and assure the action of spring **39** in withdrawing sleeves **32** from the annular channels between apertures in plate **23** and pins **29**, I propose positioning a second pillar or stop **20***a* between pillar **20** and the piston. Rod **36** will slide in a bearing in the upper part of stop **20***a*. On the end of the rod **36** beyond the stop is an enlarged obstruction such as cross pin **36***a* which contacts the stop with the forward movement of the piston. When advancement of the movable plate **31** is arrested in this manner sleeves **32** are withdrawn from the holes in pressure plate **23**.

Surrounding the piston at the open end of the pressure cylinder is a seal ring **40** held in place by a gland **41** bolted to the cylinder. This gland and seal ring produce a pressure-tight fit between the pressure cylinder and piston. At the bottom and in the rear of the hollow piston is a liquid drain **42**, flexibly connected to pipe **42***a* for carrying off the extracted liquid. A check valve not shown may be used in the outlet pipe to retain a limited amount of liquid as back wash.

In operation absorbent material containing liquid to be extracted is supplied through pipe **12**. Reciprocation of the piston **14** charges increments of the material into pressure cylinder **10** in front of the pressure plate **23**. When the cylinder is filled and the material compacted by the action of the piston, liquid, gases and/or vapors and solids dissolved or suspended by the fluids pressed from the absorbent substance flows through the annular channels between filter pins **29** and apertures in the front pressure plate into the space between the movable plate **31** and pressure plate **23**. Ducts **34** in the movable plate and ducts **28** in the fixed plate permit passage of the liquid rearwardly through the hollow piston to drain opening **42** and out through the flexible connection.

With the reciprocation of the piston absorbent material or gummy matter, which may include incrustants separated from the vegetable fiber waxes, resins or other material produced by action of the chemical used as a digestion liquor or contained in the material will tend to accumulate in the annular channels formed by the filter pins and apertures in the pressure plate. In order to prevent accumulation of substances which would tend to clog these annular passageways and to facilitate passage of liquid through the annular channels, the channels must be open, free and clear for the passage of liquid on the pressure or forward stroke of the piston and cleaned of accumulations or clogging substances during the backward or rearward stroke of the piston.

To accomplish this when the piston moves forward the force of the liquid entering the annular channels, the rearward force of compression spring **39**, and abutment of cross pin **36***a* against stop **20***a* will arrest forward movement of the plate upon which are mounted cleaning sleeves **32**. Continued forward movement of the piston advances pressure plate **23** to a position where sleeves **32** are withdrawn from the channels. This permits unobstructed passage of liquid, gases, vapors, etc., through the pressure plate. On arrival of the piston at the end of the pressure stroke the cleaning tubes or sleeves **32** will be fully retarded and entirely withdrawn from the face plate. With the reversal of the travel of the piston in its reciprocation and near the end of its backward stroke stop rod **36** will abut against the stationary member or stop **20** causing the movable plate **31** to abruptly cease following the piston travel and with further movement of the piston rearwardly cleaning sleeves **32** will move forwardly through the liquid channels in the pressure plate cleaning them of clogging material.

Continued reciprocation of the piston with the interrupted reciprocation of the movable plate as explained will produce open unobstructed channels for the passage of liquid through the pressure plate during the pressure stroke and a self-cleaning operation consisting of extruding the sleeves through the annular channels during the rearward stroke of the piston.

While the invention has been described in connection with its use in the production of pulp from vegetable material, it may as well be used elsewhere where it is desired to remove liquid from absorbent substances. As many possible embodiments may be made of the invention without departing from the scope thereof, it is understood that all matter herein set forth or shown in the drawing is to be interpreted as illustrative and not in a limiting sense.

From the foregoing it will be seen that the invention is well adapted to attain all of the ends and objects set forth together with other advantages which are obvious and which are inherent to the structure.

Having thus described my invention, I claim:

1. A self-cleaning press for removing liquid from an absorbent material comprising a pressure vessel having inlet and outlet openings for charging and discharging the absorbent material, a hollow piston reciprocating therein, apertures in the pressure face of the piston, filter pins registering with said apertures to form annular liquid channels for the passage of the extracted liquid, and a liquid drain from the piston.

2. A self-cleaning press for removing liquid from an absorbent material comprising a pressure vessel having inlet and outlet openings for charging and discharging the absorbent material, a hollow piston reciprocating therein, apertures in the pressure face of the piston, filter pins registering with said apertures to form annular liquid channels for the passage of the extracted

liquid, reciprocating sleeves in the annular liquid channels, surrounding the filter pins and synchronized with the reciprocation of the piston to permit passage of the extracted liquid and clean said channels of accumulating solids, and a liquid drain from the piston.

3. A self-cleaning press for removing liquid from an absorbent material comprising a pressure vessel having inlet and outlet openings for charging and discharging the absorbent material, a hollow piston having a pressure face reciprocating therein and compacting the material within the vessel, apertures in the pressure face of the piston, a fixed disk within the hollow piston, filter pins carried by the fixed disk and registering with said apertures to form annular liquid channels for the passage of extracted liquid, a movable disk intermediate the fixed disk and apertured pressure face, sleeves mounted on the movable disk and surrounding the filter pins and reciprocating in the annular liquid channels for removing accumulated solids, and a liquid drain from the piston.

4. A self-cleaning press for removing liquid from an absorbent material comprising a pressure vessel having inlet and outlet openings for charging and discharging the absorbent material, a hollow piston having a pressure face reciprocating therein and compacting the material within the vessel, apertures in the pressure face of the piston, a fixed disk within the hollow piston, filter pins carried by the fixed disk and registering with said apertures to form annular liquid channels for the passage of extracted liquid, a movable disk intermediate the fixed disk and apertured pressure face, sleeves mounted on the movable disk and surrounding the filter pins and reciprocating in the annular liquid channels for removing accumulating solids, means for causing reciprocation of the movable disk relative the reciprocation of the piston to permit flow of extracted liquid and clean accumulated solids from the annular liquid channels, and a liquid drain from the piston.

5. A self-cleaning press for removing liquid from an absorbent material comprising a pressure vessel having inlet and outlet openings for charging and discharging the absorbent material, a hollow piston having a pressure face reciprocating therein and compacting the material within the vessel, apertures in the pressure face of the piston, filter pins registering with said apertures to form annular liquid channels for the passage of the extracted liquid, and guides in the annular liquid channels for centering the filter pins in the apertures of the piston face.

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